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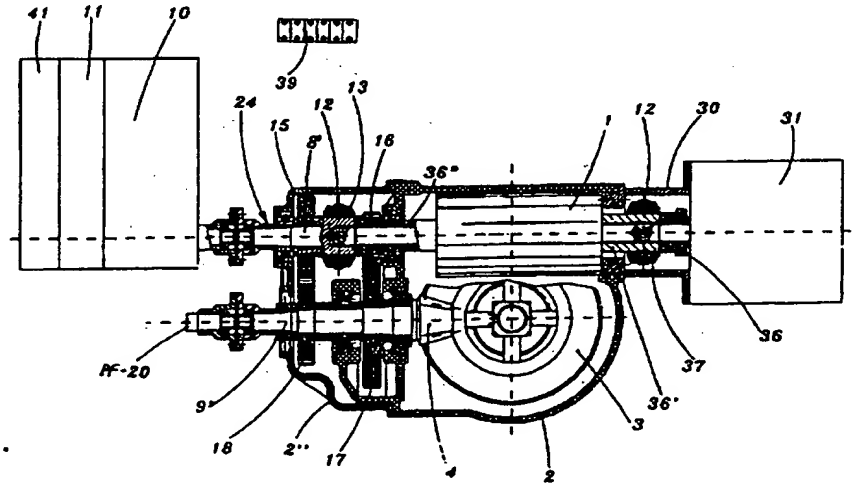
(54) Title: MODULAR, INTERCHANGEABLE ELEMENTS AND ENGINES/MOTORS, COMPOSED AND COMBINED TO TRANSMIT MOTION TO SELF-PROPELLED TRANSPORT AND WORKING VEHICLES



(57) Abstract

Modular, interchangeable engines/motors and elements for the impression and transmission of motion, including a number of different types of internal combustion engines (10), hydraulic motors (1) or electric motors (31), arranged or available on the same axis and connected to the box (2) of a differential (3). They are equipped with a gearbox and a speed reducer installed in their respective boxes (2" and 2') which, by means of clutches and switches operated by levers, are able to put the vehicle in motion using each engine/motor individually or combining each of them, stopping the engines/motors not engaged. Each of these engines/motors, accessories, gearboxes, etc. may be engaged to or disengaged from the system depending on the needs of the vehicle to be driven, bearing in mind that various combinations are possible.

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TITLE:

Modular, interchangeable elements and engines/motors, composed and combined to transmit motion to self-propelled transport and working vehicles.

BACKGROUND OF THE INVENTION

- FIELD OF THE INVENTION -

This invention refers to modular, interchangeable elements suitable for impressing motion on and transmitting it to self-propelled transport and working vehicles.

In particular, this invention refers to the use of modular, interchangeable elements and units necessary for the construction and composition of the parts which make up the assemblies capable of generating and transmitting motion in vehicles and self-propelled working machines, in order to allow the use of the same in any situation.

- DESCRIPTION OF THE PRIOR ART -

Countless types of vehicles and self-propelled machines, large and small, are known and used in applications both indoors and out, in the various sectors of industry, agriculture, construction and other fields, for transporting, pushing, lifting and towing, and for work of all kinds.

It is also known that the use of equipment or vehicles which discharge combusted gases and pollutant gases is not permitted in enclosed spaces, while specific speed and noise limits may not be exceeded for reasons of health and safety.

For this reason, the producers of these vehicles and machines (particularly working machines) are interested in the application of motors, transmission assemblies and accessories which meet these requirements. Although today's market for self-propelled equipment of this kind offers valid ways of obtaining rational, safe vehicles and equipment capable of meeting the needs and requirements, these designs are not completely satisfactory.

In general, these machines are produced directly by the user, who does not call in organised staff with specialist expertise in the various specific sectors of

production, such as motors, transmission assemblies, suspension, bodywork, trailers, etc., for their assembly and construction.

This way of working makes the construction of such machines complex and difficult, and creates problems for designers and constructors which could be avoided, simplifying and reducing the work and costs involved.

- SUMMARY OF THE INVENTION -

The object of this invention is to overcome the problems described above.

In particular, the object of this invention is to provide interchangeable modular elements and systems for the composition of the same which allow the construction of any transport or working vehicle or machine directly by the user, simply and easily.

Another object of this invention is to provide a method for the assembly of the said interchangeable modular elements for the production of self-propelled vehicles and machines suitable for any type of work and transport, and capable of moving over any type of terrain, even indoors, and for use even for small production lots.

In the most general terms, this invention allows this and other objects to be achieved using modular, interchangeable engines/motors and elements assembled together to impress motion on and transmit it to self-propelled transport and working vehicles and equipment.

These modular, interchangeable units include internal combustion engines, hydraulic and electric motors, etc., combined with each other or used to replace each other depending on the work for which the vehicle is intended, the environment in which it is to work, the distances it is to travel, and the type of terrain over which it is to move.

Examples of the items which can be produced by means of such combination and interchangeability are:

- trucks for transporting and lifting goods without using engines which cause the emission of pollutant gases;
- sweepers, mowers and sawing machines capable of moving on any flat surface, or along slopes, where there are steps, humps and hoes;
- agricultural machines equipped in any way;
- vehicles suitable for transporting people and property over terrains and slopes, even those covered with snow;

- machines for use in the most widely varying and unusual activities outdoors, in enclosed environments and workshops, which are always suitable for use for high speed travel on normal roads and those with heavy traffic.

Generally, such self-propelled vehicles and machines for transport and work are equipped with a main internal combustion engine, to which may be added, under this invention, one or more subsidiary motors to be used in combination with or replacement of the main engine.

The subsidiary motor or motors are preferably located on and combined with the box housing the vehicle's differential, combining their installation with the position of the components which make up the gearbox, or a single speed reducer.

The said subsidiary motors are installed alongside the main internal combustion engine with which such vehicles are equipped, allowing them to be used as necessary and in all cases in combination with or replacement of the engine.

These subsidiary motors, added to the existing main engine, allow such self-propelled vehicles or machines to be used on any road, at any speed in the presence of adverse working conditions and circumstances with regard to the force they are required to provide, and the complexity of the application.

There are advantages achieved by the use of modular, interchangeable units combined together to impress motion on and transmit it to self-propelled transport and working vehicles and equipment. They include:

- reduction and containment of the expenses for their manufacture, especially in the case of production of special self-propelled machines;
- possibility of producing complex equipment by simply combining modular elements;
- possibility of producing vehicles fitted with internal combustion engines combined with hydraulic and/or electric motors, where the said engines/motors are able to move the vehicle or the machine on which they are installed, even each vehicle is equipped with two, four or more drive wheels, together and/or individually;
- possibility of constructing vehicles fitted with a number of engines or motors which can be used immediately in the most widely varying working circumstances, achieving these immediate transformations by means of simple operations which can be carried out by the driver himself;

- the possibility of producing machines fitted simultaneously with an internal combustion engine, an electric motor or a hydraulic motor, or any type of motor which proves suitable for the use to be made of the machinery;
- the possibility of producing equipment with permanently installed subsidiary motors;
- ease of positioning and replacement of the above-mentioned modular units which offers the possibility of assembly, removal, replacement and completions through simple operations which can be carried out even by those who have only limited knowledge of mechanics;
- possibility of producing or modifying machines or vehicles available on the market, by purchasing the necessary items, prepared and arranged in boxes and ready for installation.
- generation of a high drive torque and the power necessary for driving machines intended even for the transport of considerable loads;
- simplicity of structure, since the subsidiary motor or motors are connected on the same axis as the main internal combustion engine installed on the vehicle.

- BRIEF DESCRIPTION OF THE DRAWING -

This invention can be better understood from the description which follows, in which reference is made to the enclosed drawings representing a number of preferred embodiments, provided as examples but not limiting the possible applications, where:

FIG. 1 represents the schematic view of a transverse and vertical section of the box of a differential of a vehicle, comprising a gear wheel which may be used by the speed change gearbox or the speed reducer;

FIG. 2 represents the schematic view of a transverse vertical section of a box which contains and guides the toothed wheel necessary for the speed reducer;

FIG. 3 is a schematic representation of an internal combustion engine combined with a hydraulic pump and/or an electrical generator, connected to electrical storage batteries;

FIG. 4 represents the schematic view of a transverse section of a drive shaft for a second differential, necessary for a vehicle equipped with four wheel drive;

FIG. 5 represents the schematic view of a cross vertical section of a second differential, necessary to allow two other drive wheels to be added to the first;

FIG. 6 represents the schematic view of a cross vertical section of an additional drive shaft to be used as power take-off;

FIG. 7 represents the schematic view of the vertical section of a second box containing the gears necessary to form a speed change gearbox;

FIG. 8 represents the schematic view of the vertical section of a clutch for transmission of the motion;

FIG. 9 illustrates the representative schematic view of a hydraulic motor, with mounting lid;

FIG. 10 illustrates the schematic view of an electric motor, with anchoring support and relevant connecting shaft;

FIGS. 11 to 23 represent, in schematic form, of a number of examples of compositions and combinations produced by combining the modular elements referred to in the foregoing illustrations, in particular:

FIG. 11 represents the schematic view of a section of the differential in the box of which the speed change system consists and where the differential is connected to the internal combustion engine only.

FIG. 12 represents the schematic view of the section of the differential contained in the box of which the speed reducer consists, and where the differential is connected to the internal combustion engine only.

FIG. 13 represents the schematic view of a section obtained with a plane passing along the line -AA-, as illustrated in FIG. 15, of a differential in the box of which is incorporated a hydraulic motor, equipped with gearbox, and where the differential is connected to an internal combustion engine and a hydraulic pump;

FIG. 14 represents a schematic view of a section similar to that of FIG. 13 in which the hydraulic motor is connected to a speed reducer;

FIG. 15 represents a schematic view of a section obtained with a plane passing along the line -BB- in FIG. 14, which specifies the position of the hydraulic motor;

FIG. 16 and 17 represent the schematic view of the sections obtained with a plane passing along the line -CC- in FIG. 18, of the differential, the boxes of which contain a gearbox and a speed reducer respectively: the electric motor, the internal combustion engine and the electricity generator are connected to the differential box; the same diagrams also show the electric storage batteries necessary for operation of the electric motor;

FIG. 18 represents a schematic view of a section obtained with a plane passing along the line -DD- in FIG. 17, specifying the position of the electric motor.

FIGS. 19 and 20 represent the schematic views of the sections, obtained with a plane passing along the line -EE- in FIG. 21, of a differential, the boxes of which contain the gearbox and the speed reducer respectively, and where the boxes also contain and support an electric motor and a hydraulic motor, connected to the internal combustion engine together with the hydraulic pump and the electrical power generator.

FIG. 21 represents the schematic view of a section obtained with a plane passing along the line -FF- in FIG. 20, specifying the position of the electric and hydraulic motors;

FIGS. 22 and 23 represent the schematic views of the seconds of a differential, the boxes of which contain the gearbox and the speed reducer respectively, and where the boxes support the electric motor connected to the electric storage batteries.

FIG. 24 represents the schematic view from above of a vehicle with two drive wheels, which may be the front or rear wheels, comprising the box of the differential to which the various engines/motors are connected;

FIG. 25 represents the schematic view of a section of FIG. 24 obtained with a plane passing along the line -GG-;

FIG. 26 represents the schematic view of a section of FIG. 24 obtained with a plane passing along the line -HH-;

FIG. 27 represents the schematic view from above of a vehicle with four drive wheels, which may be driven by the various engines/motors connected to the differential box, and

FIG. 28 represents the schematic view of a section of FIG. 27 obtained with a plane passing along the line -II-.

- DESCRIPTION OF THE PREFERRED EMBODIMENTS-

The modular elements illustrated in the first ten figures are those which form and make up all the drive equipment illustrated in FIGS.11 to 23, enclosed with this specification.

The drawings provide an understanding of the many possible compositions the said modular elements are able to provide.

By using the said modular elements and/or with the addition of other conventional modular components, it is possible to produce many other embodiments in addition to those illustrated in FIGS. 11 to 23, which are provided purely as examples and are not intended to put limits on the possible applications.

The first of these elements is the box (2) which contains and holds in position the differential (3). This is the basic element to which the specification refers, since all the modular elements, taken individually or in groups and represented in FIGS 2 to 10, necessary to obtain the various compositions and combinations illustrated in FIGS. 11 to 23 are connected to it. The following are connected to the box (2), between bearings: a toothed wheel (17) and the half-shafts (5), complete with flanges, bearings and cover (6') (as indicated in FIG. 21).

The second modular element in this invention is the box (2') which contains and guides a toothed wheel (16) which constitutes both the speed shift and the speed reducer, when coupled with the toothed wheel (17). A shaft (9) with the bevel pinion (4) of the differential is guided inside the box; this shaft is also combined with the coupling to which the drive shaft (fitted with universal joints (22) and flexible couplings (23), see also FIGS. 27 and 28) can be connected if necessary. The box (2') also supports the shaft (8), with the coupling (13) to which the toothed wheel (16) which makes up the speed reducer is connected (see FIG. 14).

An additional modular element in this invention is the internal combustion engine (10), to which either a hydraulic pump (11) or an electrical generator (41), or both, may be connected.

The output shaft of the engine (10) is also equipped with a coupling for connection to the speed shift gearbox, the speed reducer and the differential.

FIG. 6 shows the variable length drive shaft (PTO) which, fixed to the coupling of the shaft (9) or (9'), or to the coupling (42) of the second differential (21), see FIG. 5, is used for application of a power take-off.

The box (2") represented in FIG. 7, which contains the gears (15) and (18) (which, with (16) and (17), shown in FIGS. 1 and 2, make up the gearbox), is combined with the box (2) of the differential (3) in order to define the composition of this device necessary for variation of the transmission ratios. The said box (2") supports the shaft (8') and the shaft (9') with bevel pinion (4); these shafts are different from the foregoing shafts (8) and (9), since they carry the gears (15) and (18) where both are fitted with couplings in order to obtain various connections.

FIG. 8 shows the element (36') for the clutch (37) which permits the transmission of motion when the electric motor (31) is also connected to the hydraulic motor (1) (see FIGS 19 and 20).

The hydraulic motor (1), inserted in the cavity of the box (2) and retained inside the same by the cover (6) see FIGS. 9, 13 and 14 has its output shaft projecting from the box to permit other connections required. The said shaft is positioned on the same axis (M) as the output shafts of all the motors, which can be used to equip the various compositions to be produced (see FIGS. 19 and 20). This is one of the distinctive features of the system suitable for vehicles concerned.

The electric motor (31), see FIGS. 10, 16, 17, 19 and 20, is connected to the box (2) by means of the flange (30). This motor (31) is equipped with the clutch (37), the element (36), the shaft (34) with bushing (35) and spacer (34') to meet the different assembly requirements in relation to the needs which arise, see FIGS. 16 and 17, without the hydraulic motor (1), where the space allocated to the hydraulic motor is occupied only by the output shaft (34).

FIG. 5 shows a second differential (21), from which the half-shafts (5), identical to those of the differential (3), lead out (also see FIG. 21). This consists of the elements already described, and also comprises a box (2") with shaft fitted with a coupling (42).

This differential (21) is used when the vehicle on which it is installed has four instead of two drive wheels (14). The boxes (2) and (2') of which it consists contain all the elements listed for the differential (3), with the addition of the coupling (42) necessary for the power take-off, driven by the gears (15) and (18), also supported by the lid (44).

As already mentioned, all these elements which have been described are used to make up the assemblies which impress motion on and transmit it to the drive wheels (14), whether there are two of them (see FIGS. 24 and 25) or four (see FIGS. 27 and 28).

These compositions, always obtained using the same elements or the same modular units, are illustrated in FIGS. 11 to 23.

Figures 13, 14 and 15 illustrate the combination of an internal combustion engine (10) with a hydraulic motor (1) incorporated in the box (2) of the differential (3). As necessary, the vehicle may be driven directly by the engine (10) or by means of the hydraulic motor (1), also powered by the engine (10) which acts by means of the hydraulic pump (11).

The hydraulic motor (1), held in the correct position by the covers (6) and (7) and connected to the shafts (8), (9), (8') and (9'), to the gears (16), (17), (15)

and (18) of the speed reducer or gearbox, to the half-shafts (5) and to the clutches (13). The position of the hydraulic motor (1) is such as to allow its output shaft to project from both ends and to be on the same axis M as the shaft (8) and (') which connects the engine (10) to the speed reducer contained in the box (2') or to the gearbox contained in the box (2"), and thus to the vehicle's differential (3).

Installation of the hydraulic motor (1) in this position also allows the engine (10) to be used when the vehicle is travelling on normal roads, while the added hydraulic motor (1) is used when the vehicle is travelling at lower speeds, when the vehicle is travelling on steep, uneven roads, or when the vehicle is used for heavy-duty transport and other duties.

This is also made possible by means of the use of the same transmission, speed reducer, and engagement and disengagement equipment as for the engine (10) mounted on the vehicle.

These elements also permit the hydraulic motor (1) to drive the shaft (9) or the shaft (9') when required, either to drive a power take-off by means of the PTO shaft, or in order to drive the second pair of drive wheels (14), as shown in FIGS. 27 and 28, by means of the transmission shaft (20).

The installation on the vehicle of a hydraulic motor (1) in addition to the engine (10) provides the possibilities already stated, which are:

initial direct engagement of the engine (10), without the motor (1), then with engagement of the motor (1) driven by the engine (10). These engagements are made by means of simple operations carried out by hand by the driver when necessary, for which the vehicle has to be halted briefly.

In order to driven the vehicle by means of the hydraulic motor (1), a by-pass (not shown in the drawings) acting on the two lines (19) which connect the pump (11) driven by the engine (10) must be connected.

As in other cases, these connections are made using the levers provided (also not shown in the drawings, since they are familiar items of equipment). By means of the fork (12), these levers move the clutch (13) and the by-pass so that the vehicle is driven by means of the engine or the motor, and the other is disengaged.

These control levers act as follows:

- they disengage the engine (10) so that it no longer drives the vehicle;
- they disengage the engine (10) so that it only drives the pump (11);

- they engage the hydraulic motor (1), restoring the flow of pressurised oil (by means of the by-pass) so that it can provide the require driving force by means of the pump (11) which powers it;
- when required they disconnect the by-pass, cutting off the flow of pressurised oil to the motor (1), so that it is not possible for the engine and the motor to act simultaneously on the shaft (9) or shaft (9');
- they disengage the gear (15) by means of the clutch (13); running idle, this forces the engine (10) to drive only the pump (11), preventing it from interfering with the motor (1);
- they ensure that the connections in the oil circuit leading from the pump (11) are made when the engine (10) is working to drive the vehicle on normal roads, so that pressurised oil no longer flows along the by-pass to the hydraulic motor (1), which turns idle, while the clutch (13) allows the gearbox to be used to permit the vehicle to be driven at the necessary speed;
- so that the hydraulic motor (1) is able to act only by means of the speed reducer and by means of the gears (16) and (17) or by means of the variations in the speed of the pump (11) obtained by operating the accelerator of the engine (10);
- so that by means of the clutch (13) indicated in FIGS. 13 and 16 and a second clutch, not shown in the drawing, identical to the first and installed in the position marked (24), the two (or more) speeds of the gearbox can also be used with the hydraulic motor (1).

The hydraulic motor (1) drives all four wheels (14) shown in FIG. 27, which become drive wheels by means of the second differential (21), the transmission shaft (20), the universal joints (22) and the flexible couplings (23).

FIGS. 16, 17 and 18 illustrate the combination of an electric motor (31) with an engine (10), which is able to replace it if necessary. The electric motor (31) is connected to the box (2) containing the differential (3) with the bevel pinion (4). The said electric motor (31) is equipped to drive the vehicle when the engine (10) is disengaged from its transmission.

The electric motor (31) occupies a small space, is not bulky and is kept in the correct position and connected to the box (2) by means of a rigid flange (30). The shaft (34), the bush (35), the element (36) and the clutch (37) connect the shaft of the motor and keep it aligned with the shaft (8) or (8').

The clutch (13) drives the vehicle when the motor (31) replaces the engine (10) since it is driven by the energy supplied by the storage batteries (39). The motor (31) drives the shaft (9) and (9'), the differential (3) and the half-shafts (5) by means of the gearbox (FIG. 16) or by means of the speed reducer (FIG. 17).

FIGS. 16 and 17 show the electric motor (31), the output shaft of which is also on the same axis (M) as the shaft (8) or (8') of the shaft leading out of the internal combustion engine (10).

Installation of the motor (31) in this position advantageously simplifies construction of the system which allows use of the engine (10) when the vehicle is used for travel on normal roads, while the added electric motor (31) is necessary when the vehicle is used in enclosed working environments where the air must not be polluted, and for travelling at low speeds on steep or uneven roads, or for heavy duty transport jobs.

The electric motor (31) is installed by means of the same transmission, speed reduction, engagement and disengagement elements as for the engine (10) with which the vehicle is equipped.

The elements listed above also allow the motor (31) to drive the shafts (9) and (9'), illustrated in FIGS. 16 and 17 when necessary, in order to drive the PTO shaft or the transmission shaft (20).

The installation on such self-propelled machines of an electric motor (31) in addition to the engine (10), provides the possibilities already stated, which can be obtained:

first by engaging or disengaging the engine or the motor, by means of simple operations to be carried out by hand by the driver, for which the vehicle must be halted briefly; then by means of an electric switch (not shown in the drawings (used to make or break the necessary contacts between the electric motor (31) and the electric storage batteries (39) (see also FIGS. 24 and 27) carried on the vehicle: or by operating the electric motor (31) powered by the electricity generator (41), in this case also driven by the engine (10).

In order to switch from drive of the vehicle(s) by means of the electric motor (31), disabling the engine (10), as in other cases the driver uses levers provided for the purpose (again not shown in the drawings as they are familiar items of equipment), which operate the clutch (13) and the switch provided, by means of the fork (12).

The vehicle is driven by the engine or the motor depending on the positions of these control devices, which may:

- disengage the engine (10) so that it does not drive the vehicle when the electric motor (31) is engaged;
- disengage the engine (10) so that it can only drive the generator (41) when the vehicle or machine is working outdoors, driven by the electric motor (31);
- disengage and turn off the engine (10) when the electric storage batteries (39) are used to supply the electric motor (31), when the vehicle or machine is working in enclosed environments;
- switch on the electric motor (31) by making the contacts in the switch, allowing current to flow from the electric storage batteries (39) or from the generator (41), so that it can provide the driving force required;
- turn off the switch when the engine is to be used (10), so that the engine and motor cannot both act on the shaft (9) or (9') simultaneously;
- disengage the gear (15) by means of the clutch (13) which, turning idle, only allows the engine (10) to drive the generator (41) and prevents it from interfering with the motor (31);
- make the connections in the electric circuit, when the engine (10) is operating to power the vehicle on normal roads, so that the electric motor (31) is disconnected from the drive and disconnected by means of the clutch (37), while the clutch (13) allows use of the gearbox, see FIG. 16, or the engagement of the speed reducer, see FIG. 17, in order to allow the vehicle to be driven at the appropriate speed;
- ensure that the electric motor (31) is only able to act by means of the speed reducer, consisting of the gears (16) and (17), contained in the box (2');
- so that by means of the clutch (13) indicated in FIGS. 16 and 17 and a second clutch, not shown in the drawing, identical to the first and installed in the position marked (24) in FIG 16, the two (or more) speeds of the gearbox (located inside box (2") can also be used with the electric motor (31).

As in the cases already mentioned, the electric motor (31) is able to drive four drive wheels.

The figures from 19 to 21 illustrate the possible combinations which can be obtained with an electric motor (31), a hydraulic motor (1) and an internal combustion engine (10).

As already stated, the hydraulic motor (1) and electric motor (31) are connected to the box (2), closed by the cover (6), which contains the differential (3) with the bevel pinion (4) and from which the half-shafts (5) lead out. The hydraulic motor (1) and electric motor (31) are on the same axis (M) and are both able to act on the shaft of the engine (10).

This mode of installation allows the engine (10) to drive the vehicle when the two motors (1) and (31) are not in operation. This possibility, already described is provided by the fact that the output shafts of the engine and the two motors are all located along the same axis (M), which is the axis of shaft (8) or (8'), the axis on which clutches (13), (37) and the clutch indicated in position (24) (not shown), necessary for establishing which of the three will drive the vehicle, act, the axis of the bush (36), the axis of the element (36') and the axis of the spacer (36").

The engine and motors are placed so that they are all able to drive the vehicle using the same differential (2), the same gearbox, consisting of the toothed wheels (15), (16), (17), and (18) (see FIG. 19), or the same speed reducer, comprising the toothed wheels (16) and (17) (see FIG. 20).

The engine runs on fuel, preferably petrol or Diesel fuel, the electric motor is powered by the storage batteries (39) or the power generator (41) and the hydraulic motor is driven by the hydraulic pump (11). Both the generator (41) and the pump (11) are driven by the internal combustion engine (10) which makes the entire system independent.

Using the clutches illustrated, operated by means of lever and acting by means of the forks (12), as in other cases, the system allows:

- use of the engine (10) when the vehicle is to travel on normal roads at speeds appropriate to road traffic;
- use of the hydraulic motor (10) when the vehicle is to travel at low speeds, to move over steep or uneven roads, or to be used for heavy-duty transport or other tasks where load speeds, difficult to achieve with internal combustion engines, are required;
- use of the electric motor (31) powered by the electricity supplied by the storage batteries (39), when the vehicle is used in enclosed environments;

By means of shaft (9) or (9'), it is also possible to drive the transmission shaft (20) and/or the PTO shaft.

The installation of these two motors on self-propelled vehicles or machines in addition to the internal combustion engine (10) provides the possibilities which have been described and can be achieved:

- by activating only the engine or either of the two motors, the other two remaining out of use;
- by means of the appropriate operations, carried out by hand by the driver when necessary, for which the vehicle must be briefly halted;
- by carrying out the necessary operations using the levers which with the vehicle is equipped, which move the clutches, the switch for making or braking the necessary contacts between the electric motor (31) and the electric storage batteries (39) which the vehicle carries, or the connections between the electric motor (31) and a possible electricity generator (41) driven by the engine (10);
- by operating a by-pass to establish or cut off the flow of pressurised oil from the pump (11) to the hydraulic motor (1) in order to keep the latter running or switch it to idle status;

FIG. 11 and 12 represent the most simple compositions which can be obtained by means of the elements described; in other words, an engine (10) acting directly on a differential (3) enclosed in the box (2) by means of the gearbox shown in FIG. 11, while in FIG. 12 the gearbox is replaced by an ordinary speed reducer.

In this case the vehicle can again be driven by means of the transmission shaft (20) which is connected to the second differential (21) and the power take-off, by means of the PTO shaft.

Although the invention has been described in conjunction with specific embodiments, it is evident that many alternatives and variants will be apparent to those skilled in the art in the light of the foregoing description.

Accordingly, the invention is intended to embrace all of the alternatives and variations which fall within the spirit and scope of the appended claims.

CLAIMS

1. Modular, interchangeable elements and engines/motors, composed and combined to transmit motion to self-propelled transport and working vehicles, in order to allow their use in any situation, comprising at least three types of propulsion unit: an internal combustion engine (10); a hydraulic motor (1) and an electric motor (31), which, installed on the same axis (M) and connected to the box (2) of a differential (3) and a second differential (21) are equipped with a gearbox and/or a speed reducer placed in their respective boxes (2") and (2').

2. Engines/motors and elements as in claim 1, with the distinctive feature that there is one hydraulic motor (1) and one internal combustion engine (10).

3. Engines/motors and elements as in claim 2, with the distinctive feature that the output shaft (M) of the hydraulic motor (1) is on the same axis as the drive shaft (8) and (8') connected to the internal combustion engine (10).

4. Engines/motors and elements as in claim 2 or 3, with the distinctive feature that they comprise a clutch (13) controlling the hydraulic motor (1) and putting it into operation, when necessary, cutting out operation of the internal combustion engine (10).

5. Engines/motors and elements as in claim 2 or 3, in which the hydraulic motor (1) is controlled by a clutch (13) which disengages it when the internal combustion engine (10) comes into operation.

6. Engines/motors and elements in any one of the foregoing claims from 2 to 5, in which the hydraulic motor (1) is powered by a pump (11) driven by the internal combustion engine (10), when the latter is not driving the vehicle.

7. Engines/motors and elements as in claim 1 or 2, in which the hydraulic motor (1) is connected to a gearbox or a speed reducer.

8. Engines/motors and elements as in claim 1, with the distinctive feature that there is one electric motor (31) and one internal combustion engine (10).

9. Engines/motors and elements as in claim 8, in which that the output shaft of the electric motor (31) is on the same axis as the drive shaft (8) and (8') and is connected to the internal combustion engine (10).

10. Engines/motors and elements as in claim 8 or 9, with the distinctive feature that they comprise a clutch (13) controlling the electric motor (31) and putting it into operation, when necessary, cutting out operation of the internal combustion engine (10).

11. Engines/motors and elements, as in claim 10, in which the clutch (13) is operated by a lever acting on a switch to operate the electric motor (31),

12. Engines/motors and elements, as in claim 10, or 11, in which the clutch (13) disengages the electric motor (31) when the internal combustion engine (10) is driving the vehicle.

13. Engines/motors and elements, as in any of the foregoing claims from 8 to 12, with the distinctive feature that they include a series of rechargeable electric storage batteries (39) which supply the electric motor (31).

14. Engines/motors and elements, as in any of the foregoing claims from 8 to 13, with the distinctive feature that they include an electricity generator (41) driven by the internal combustion engine (10), which supplies the electric motor (31).

15. Engines/motors and elements as in claim 1, with the distinctive feature that there is one hydraulic motor (1), one electric motor (31) and one internal combustion engine (10).

16. Engines/motors and elements as in claim 15, in which the output shafts of the hydraulic motor (1) and the electric motor (31) are on the same axis as the drive shaft (8) and (8') and are connected to the internal combustion engine (10).

17. Engines/motors and elements as in claim 15 or 16, with the distinctive feature that the hydraulic motor (1) and the electric motor (31) are connected to the differential (3) by means of the gearbox or by means of a speed reducer.

18. Engines/motors and elements as in claim 15, 16 or 17, with the distinctive feature that they comprise clutches and switches which put the engine or motors into operation individually, while those disengaged are at a standstill.

19. Engines/motors and elements, as in claim 18, with the distinctive feature that they comprise levers which operate the clutches and the switch.

20. Engines/motors and elements, as in any of the foregoing claims form 15 to 19, in which the internal combustion engine (10), the hydraulic motor (1) and the electric motor (31) are all connected to a gearbox or a speed reducer.

21. Engines/motors and elements, as in any of the foregoing claims, with the distinctive feature that they are installed in such a way that they are able to drive two or four drive wheels.

22. Engines/motors and elements, as in any of the foregoing claims from 1 to 21, with the distinctive feature that they are installed in such a way that they are able to drive power take-offs.

23. Engines/motors and elements, as in claim 1, with the distinctive feature that they comprise an internal combustion engine (10) with either gearbox or speed reducer.

24. Engines/motors and elements, as in claims 1, 21 and 22, with the distinctive feature that they comprise a second differential (21), also installed in a box (2),, complete with speed reducer in its own box (2'), so as to drive the second pair of drive wheels, and also equipped with the coupling (42) for the PTO shaft, as power take-off.

25. Engines/motors and elements, as in any of the foregoing claims, concerning the construction of:

- trucks for transporting and lifting goods without using engines which cause the emission of pollutant gases;
- sweepers, mowers and sawing machines capable of moving on any flat surface, or along slopes, where there are steps, humps and hoes;
- agricultural machines equipped in any way;
- vehicles suitable for transporting people and property over terrains and slopes, even those covered with snow;
- machines for use in the most widely varying and unusual activities outdoors, in enclosed environments and workshops, which are always suitable for use for high speed travel on normal roads and those with heavy traffic.

FIG.1

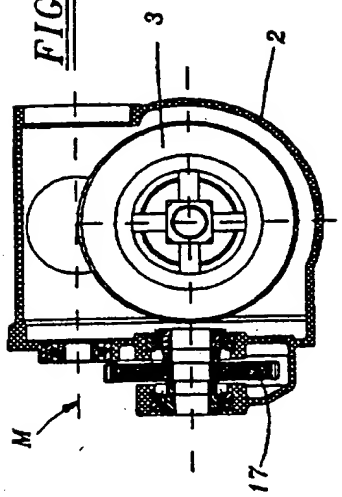


FIG.2

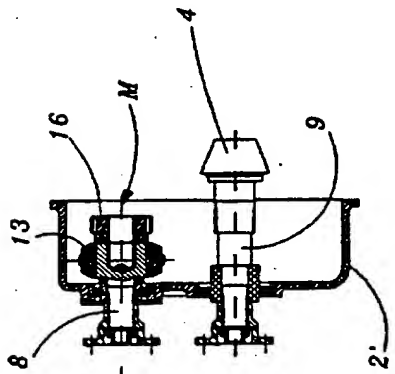


FIG.3

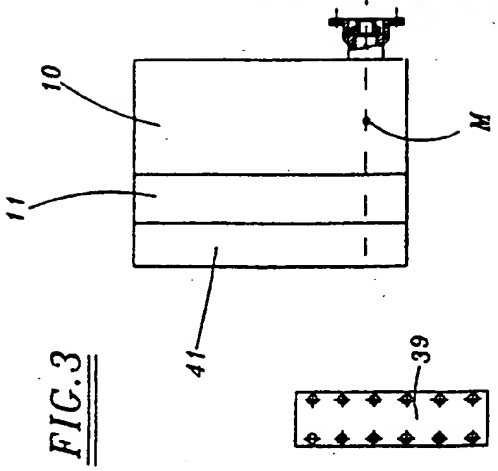


FIG.8

FIG.7

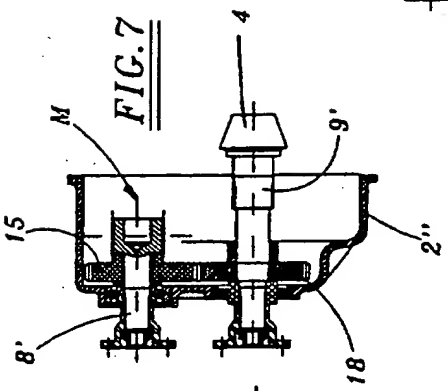
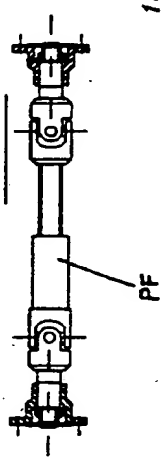


FIG.6



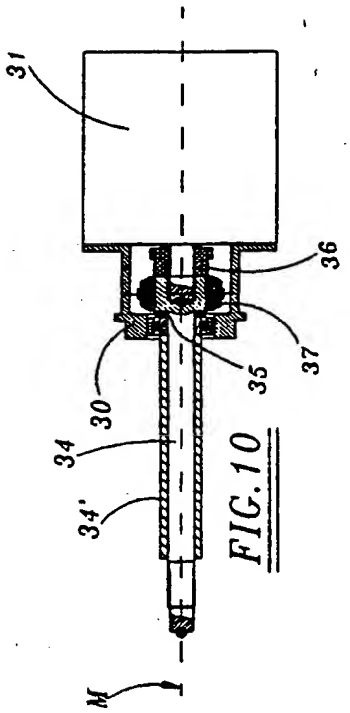


FIG.10

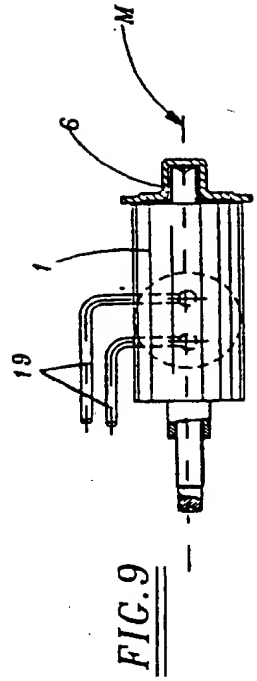


FIG.9

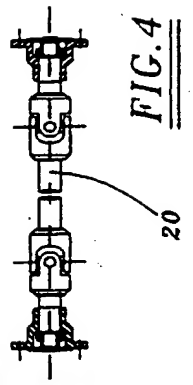


FIG.4

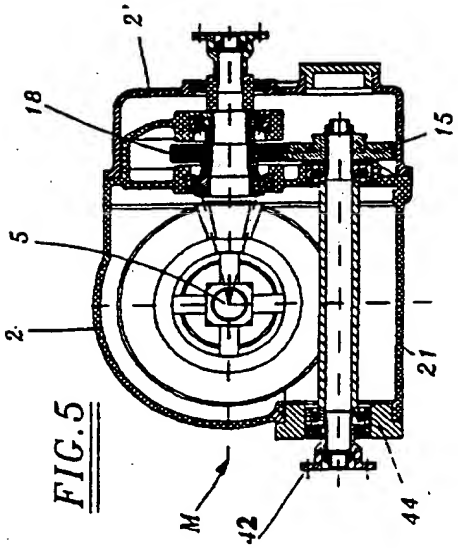


FIG.5

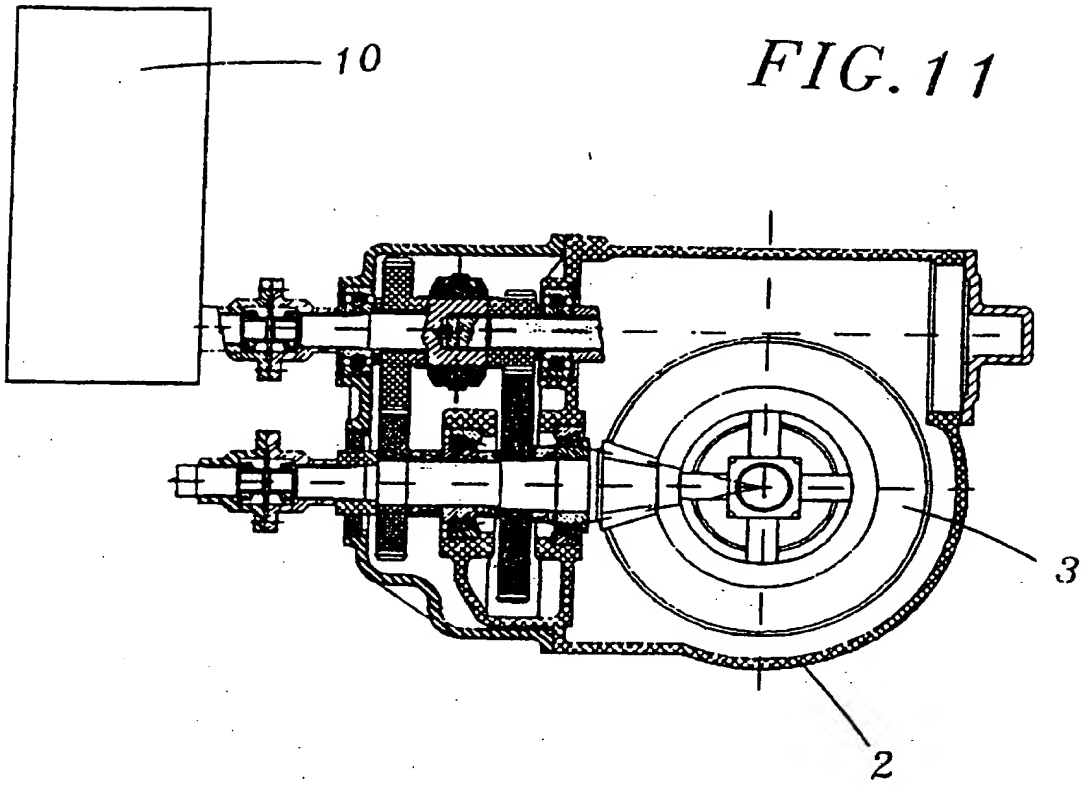


FIG. 11

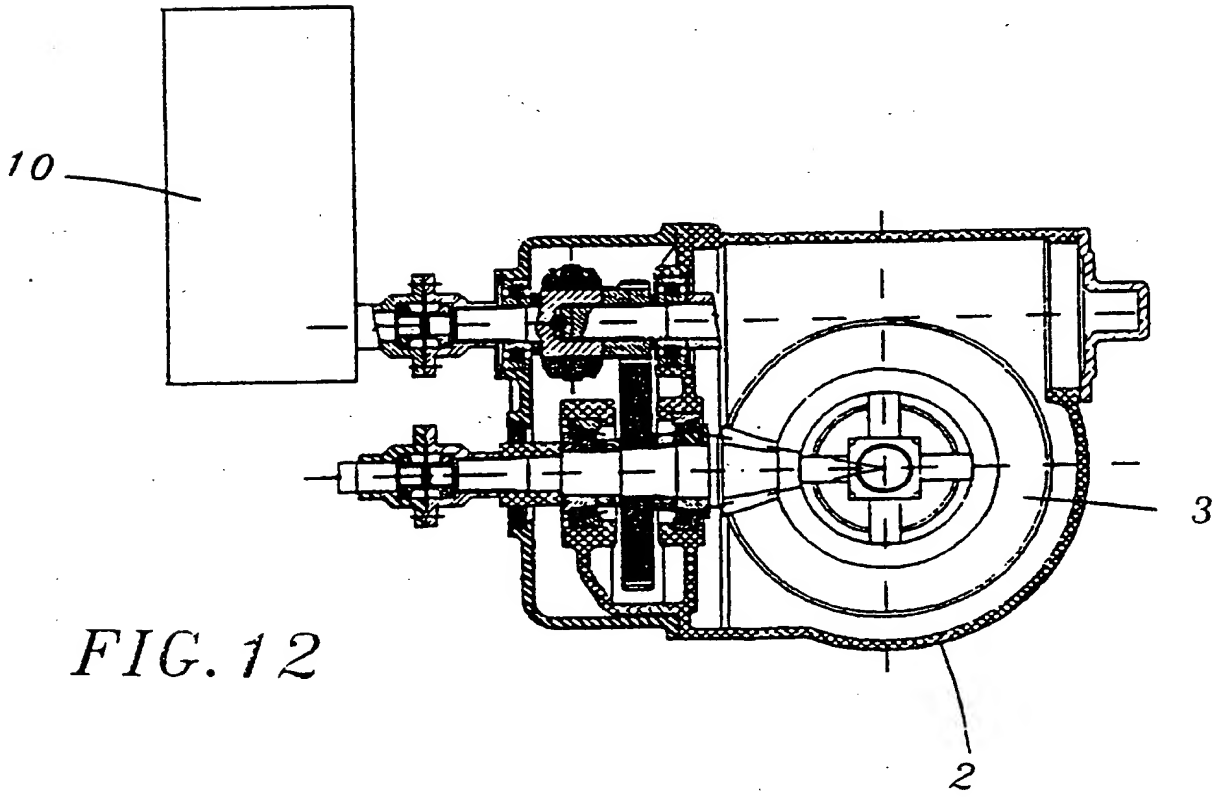


FIG. 12

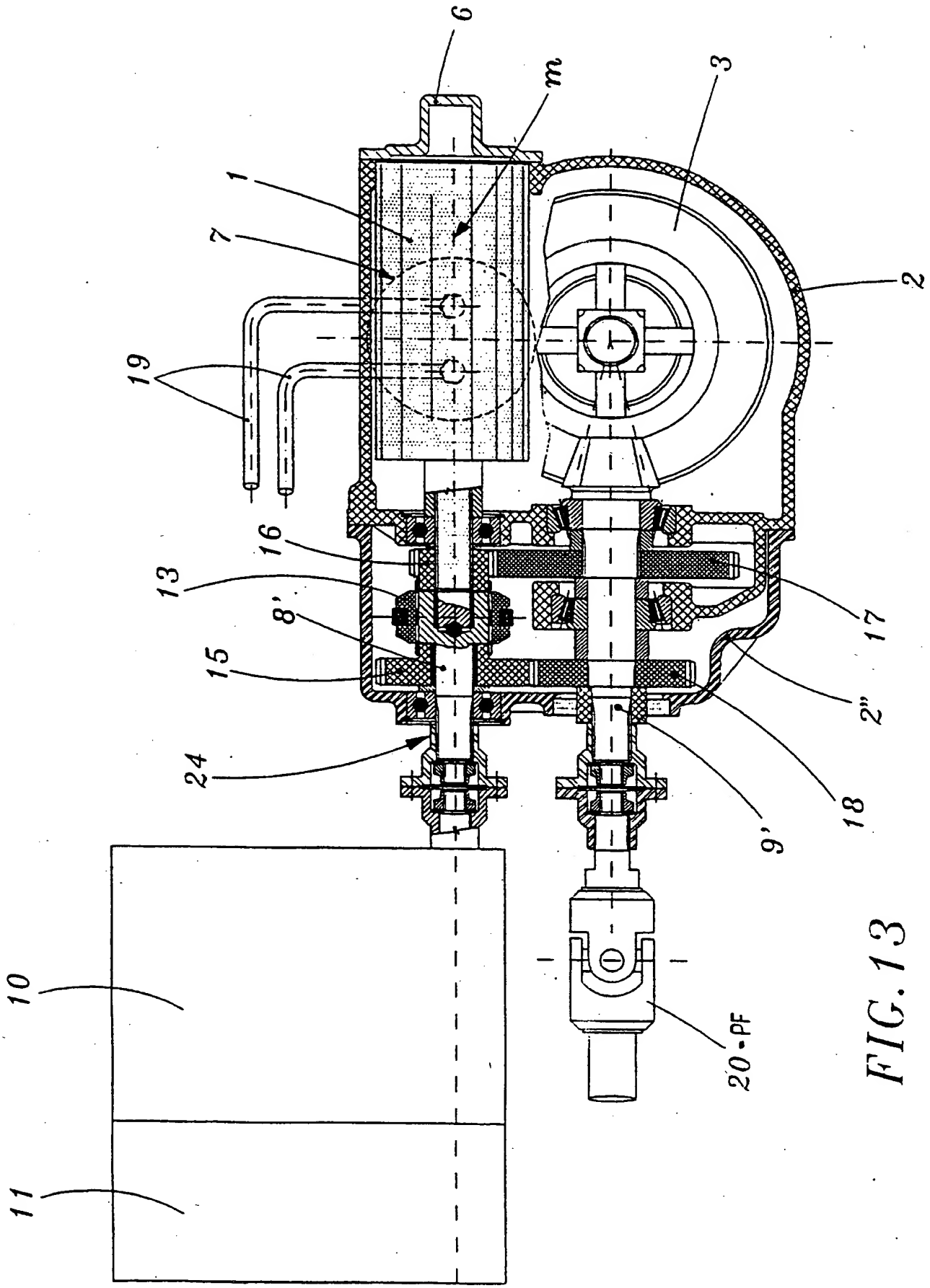


FIG. 13

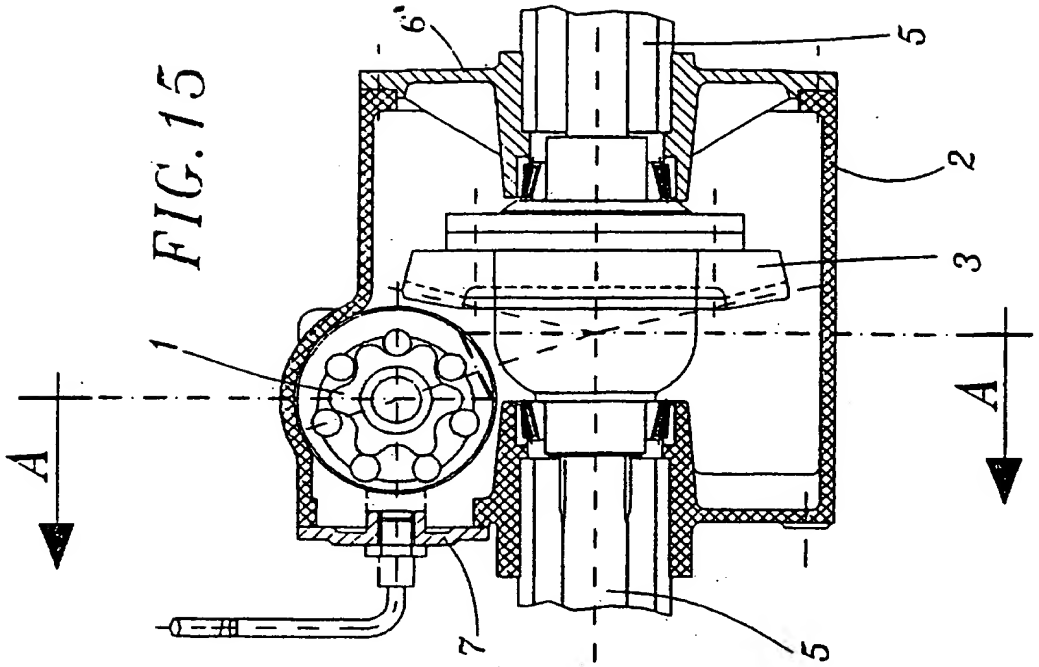


FIG. 15

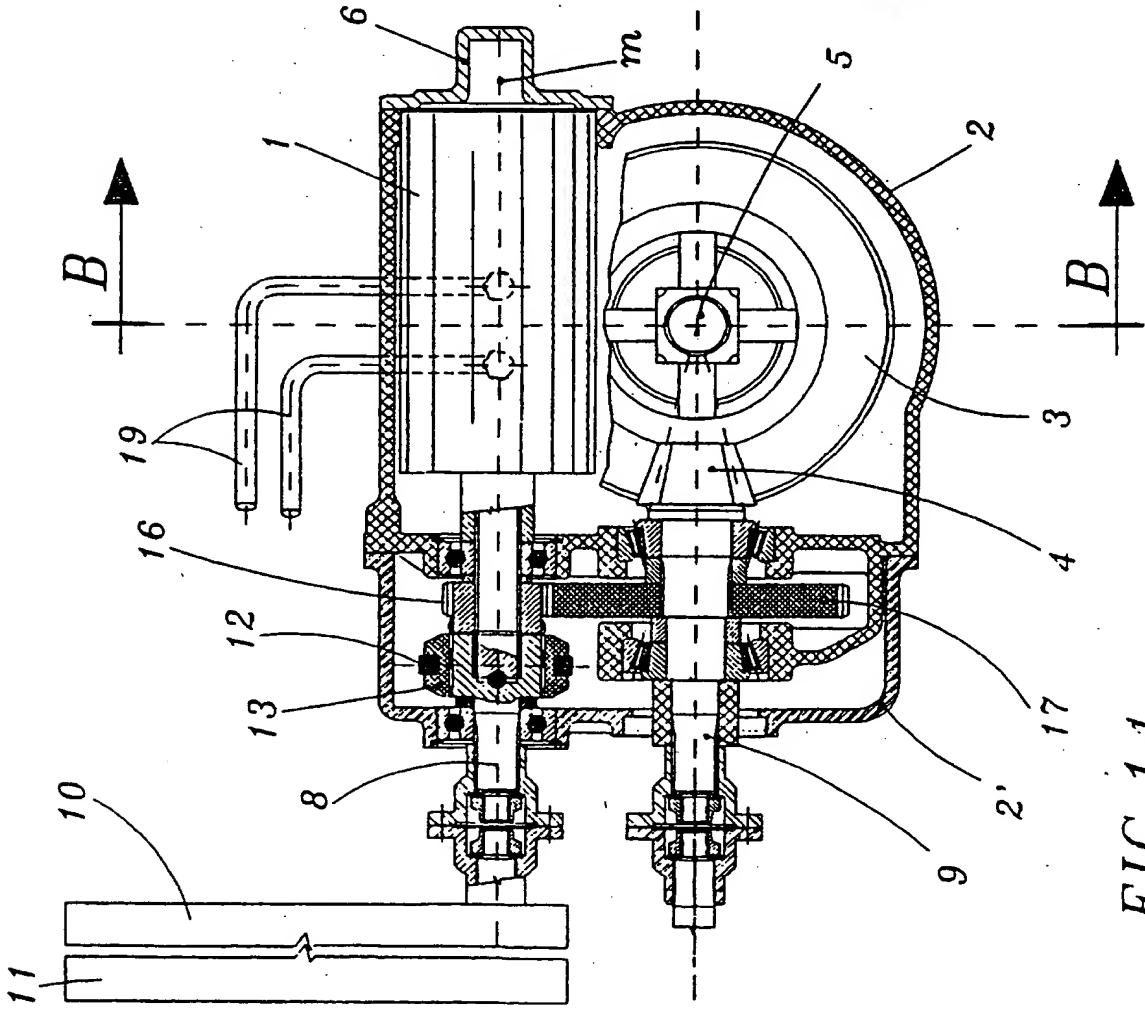


FIG. 14

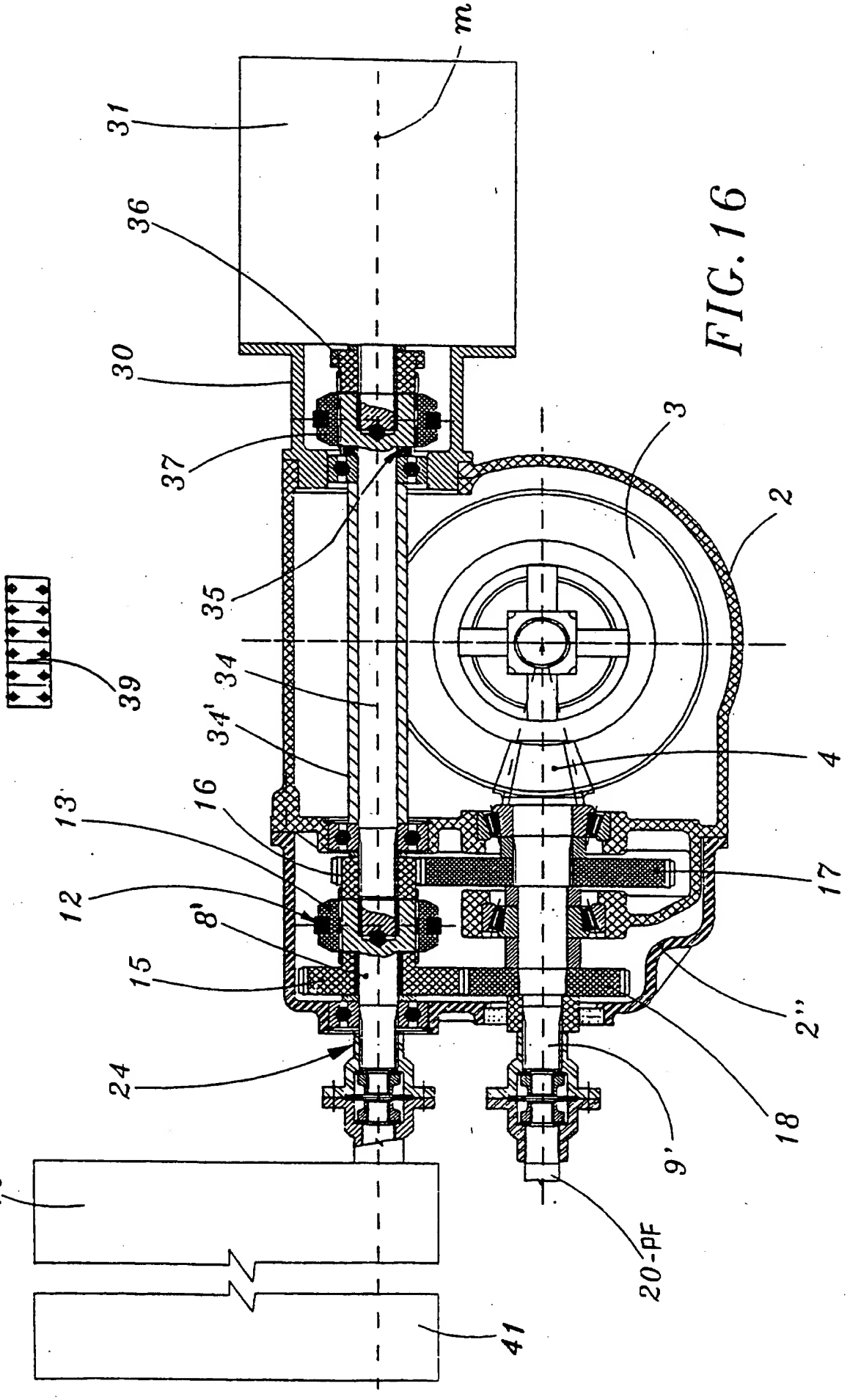


FIG. 16

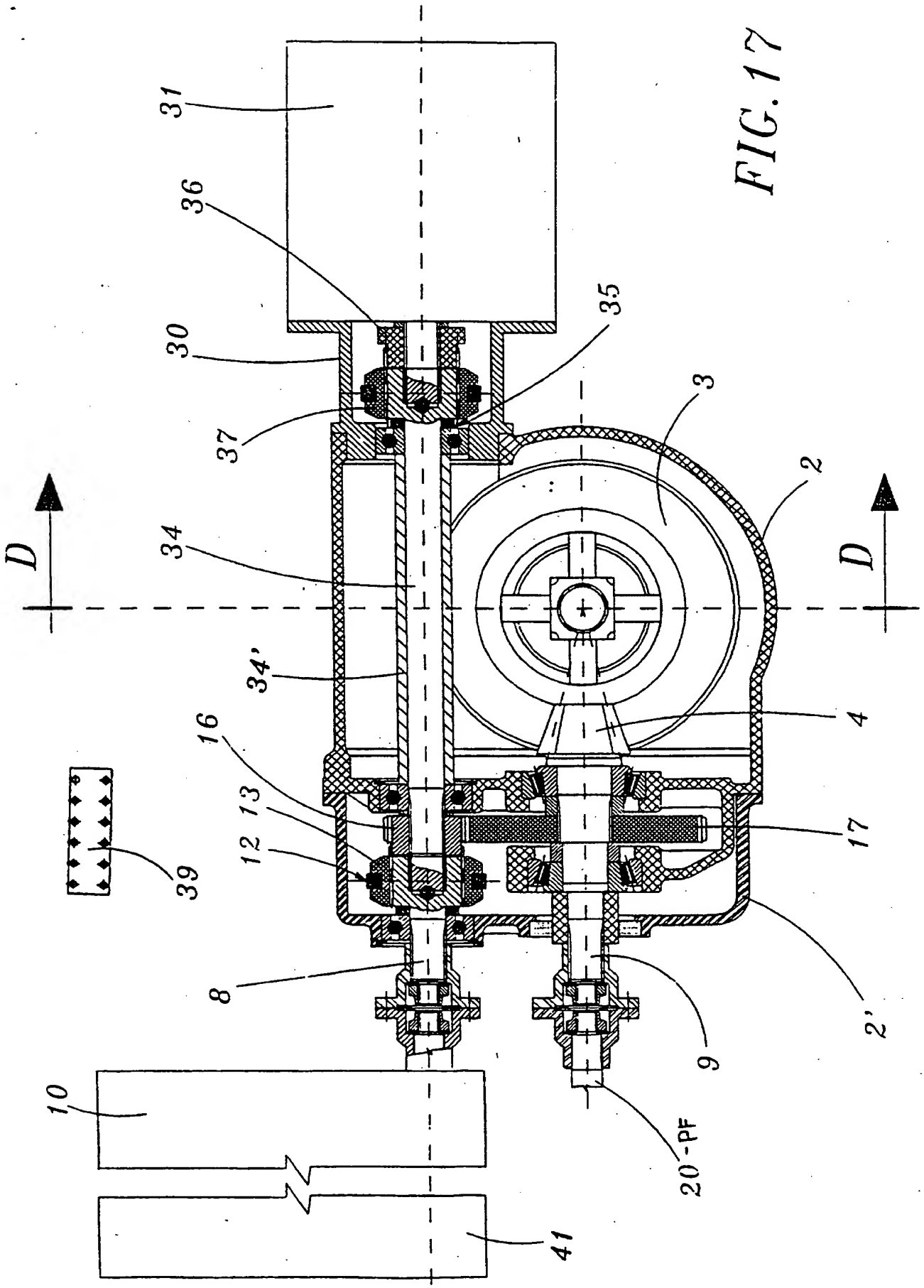


FIG. 17

FIG. 18

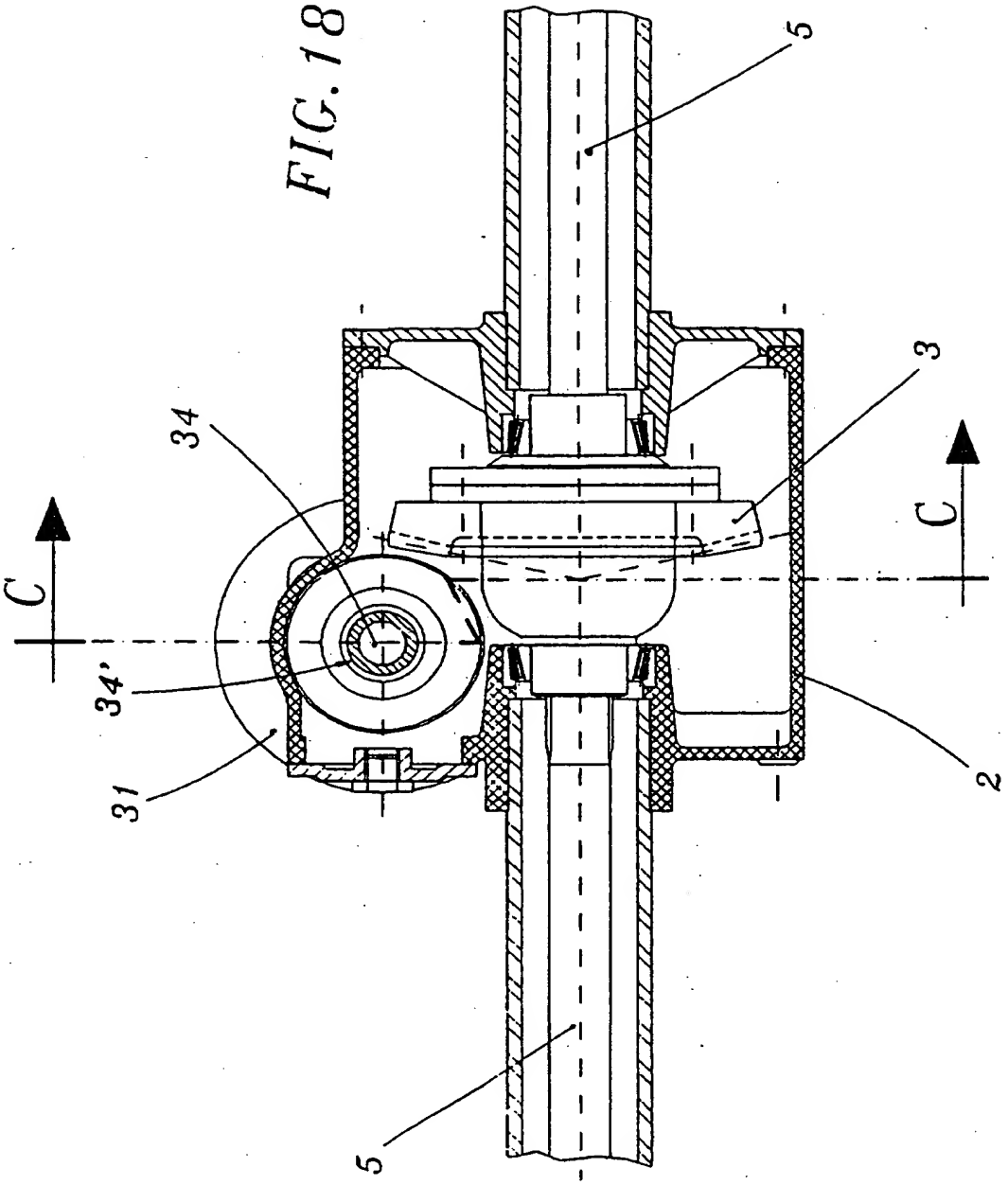


FIG. 19

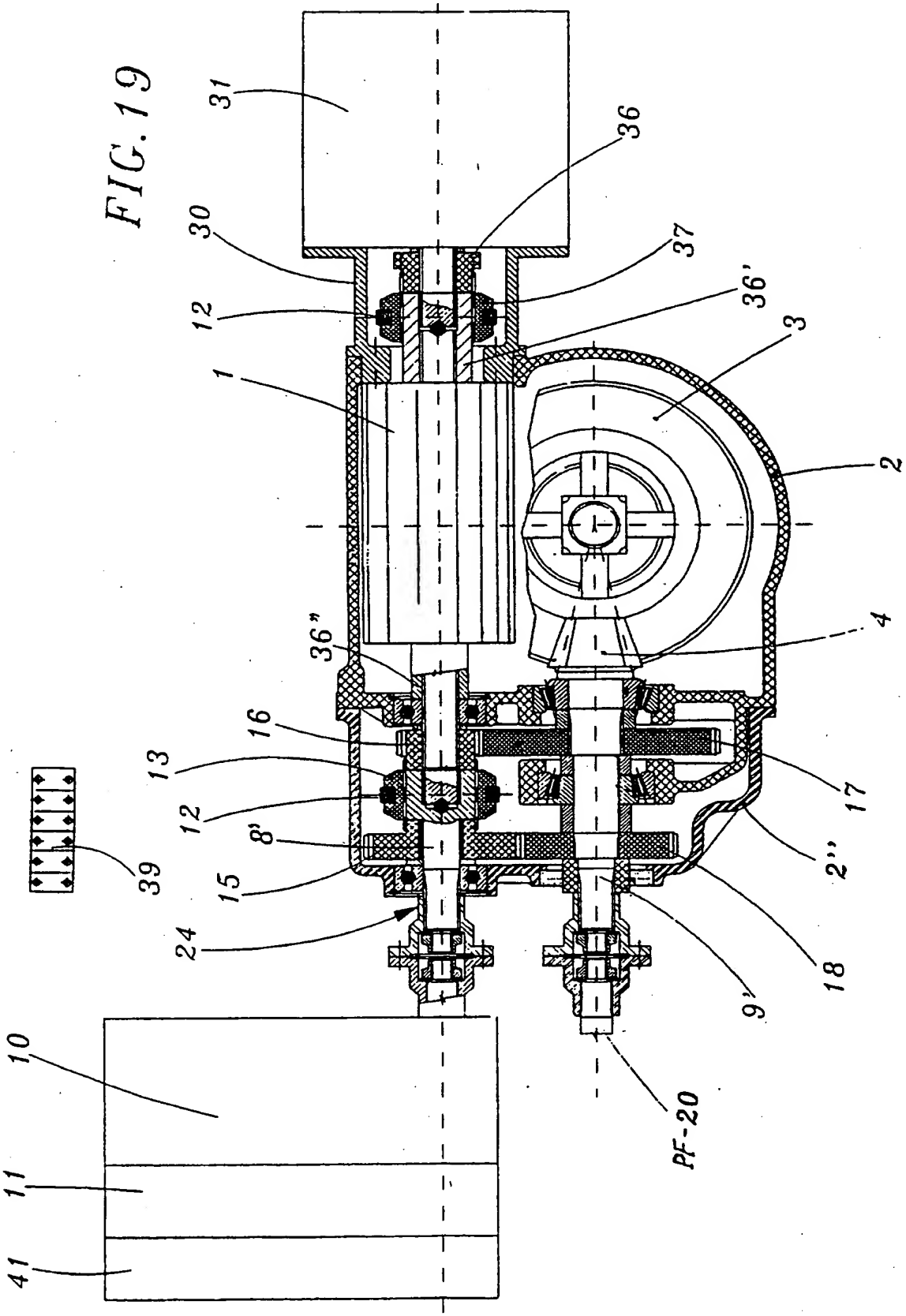


FIG.20

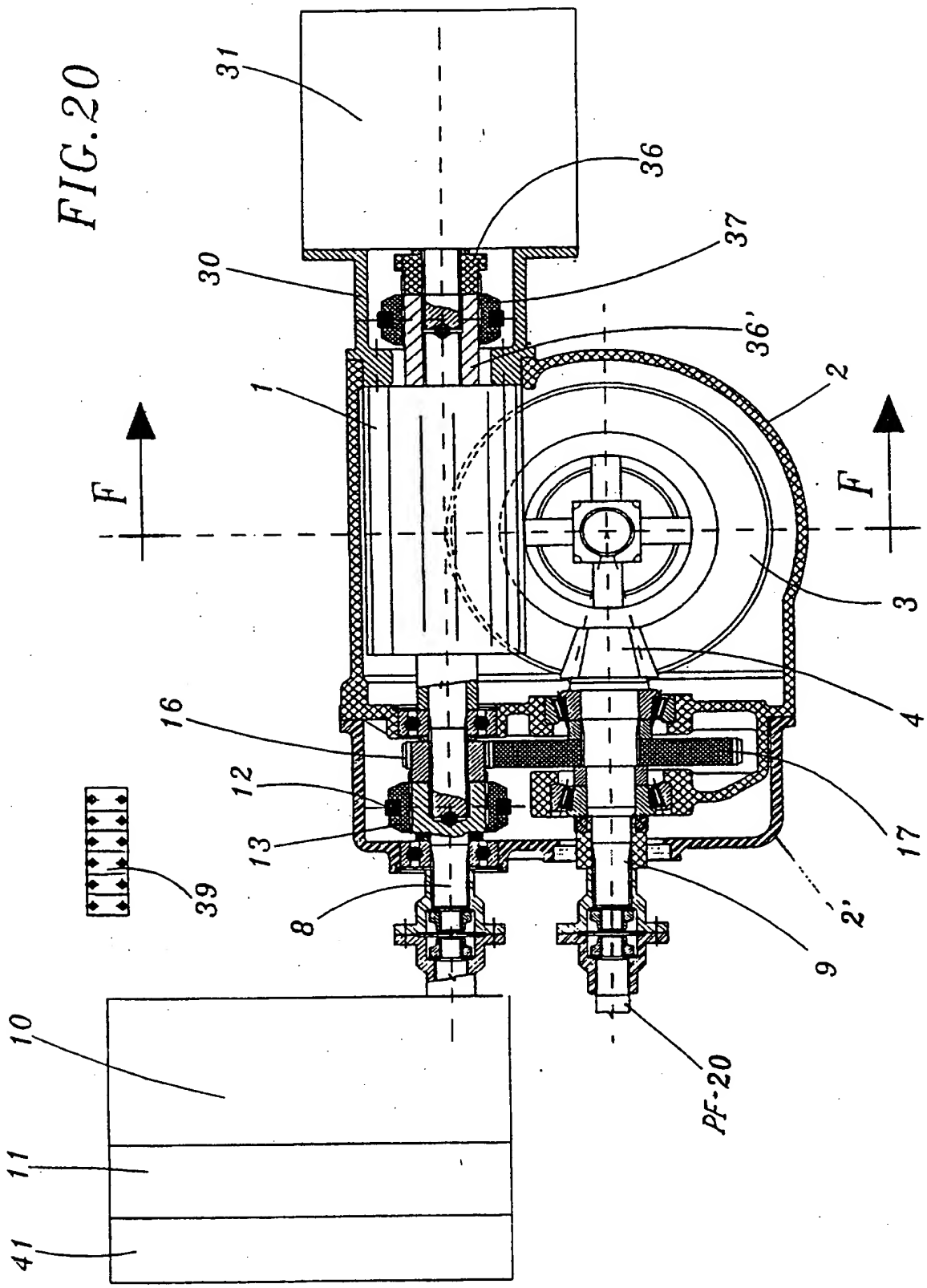
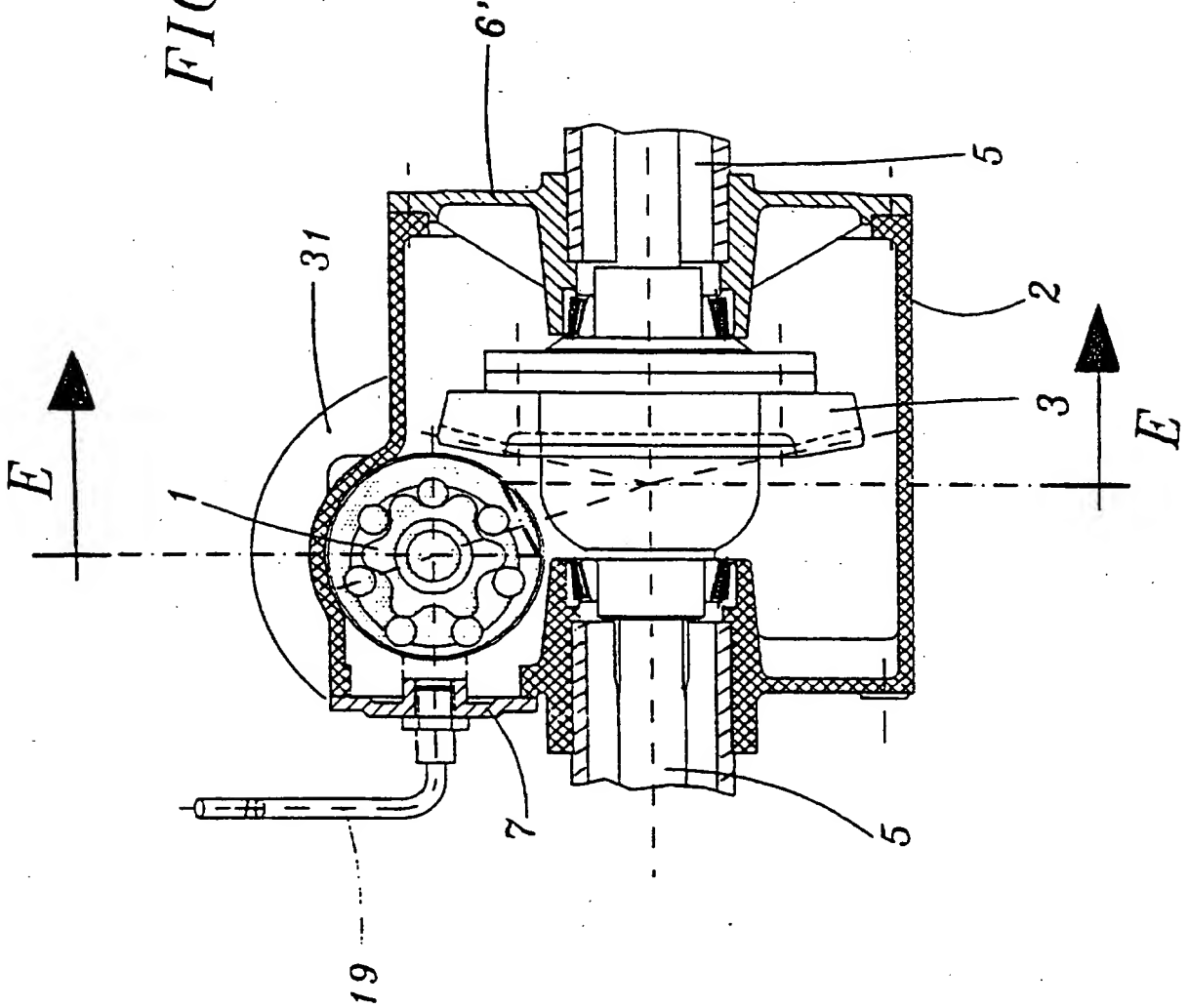


FIG.21



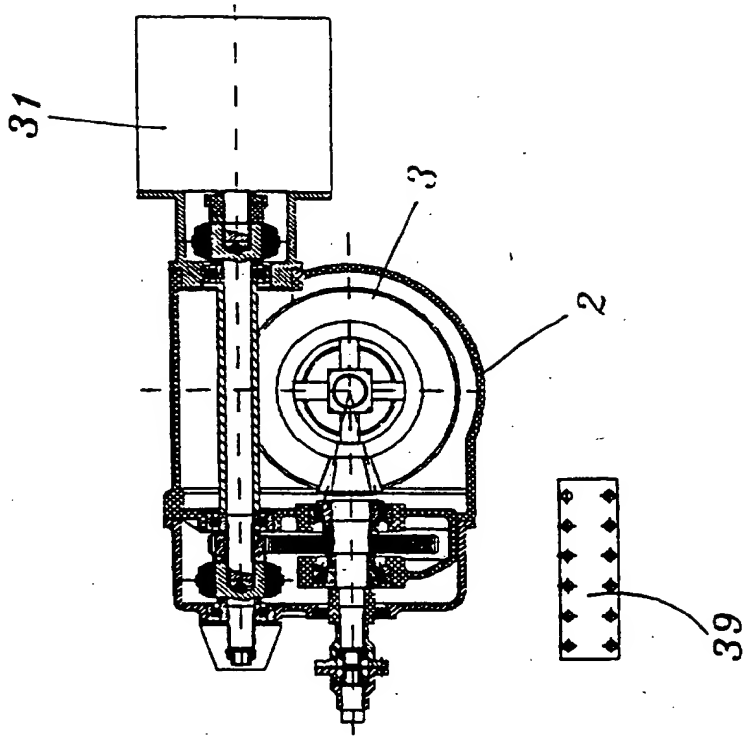


FIG.23

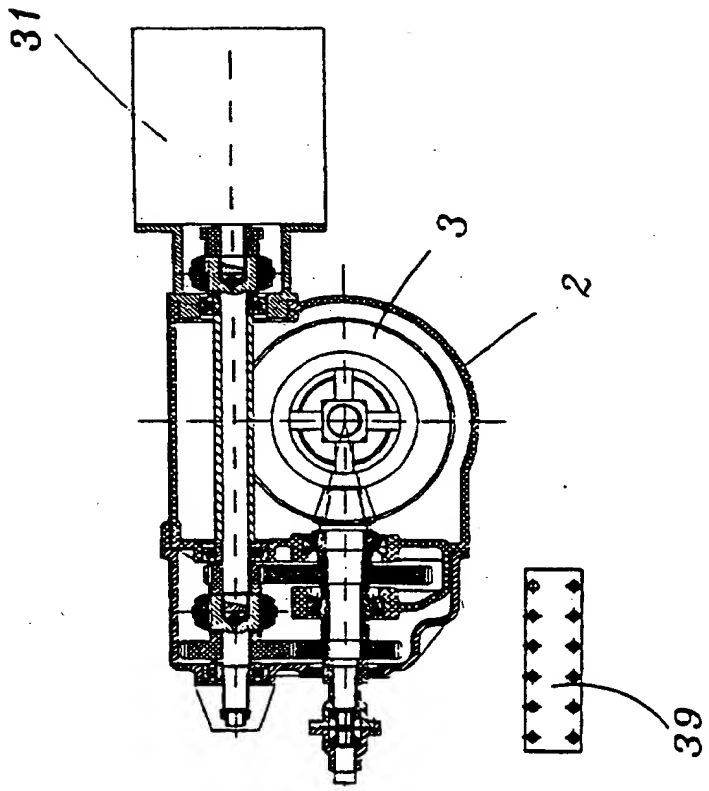


FIG.22

FIG.24

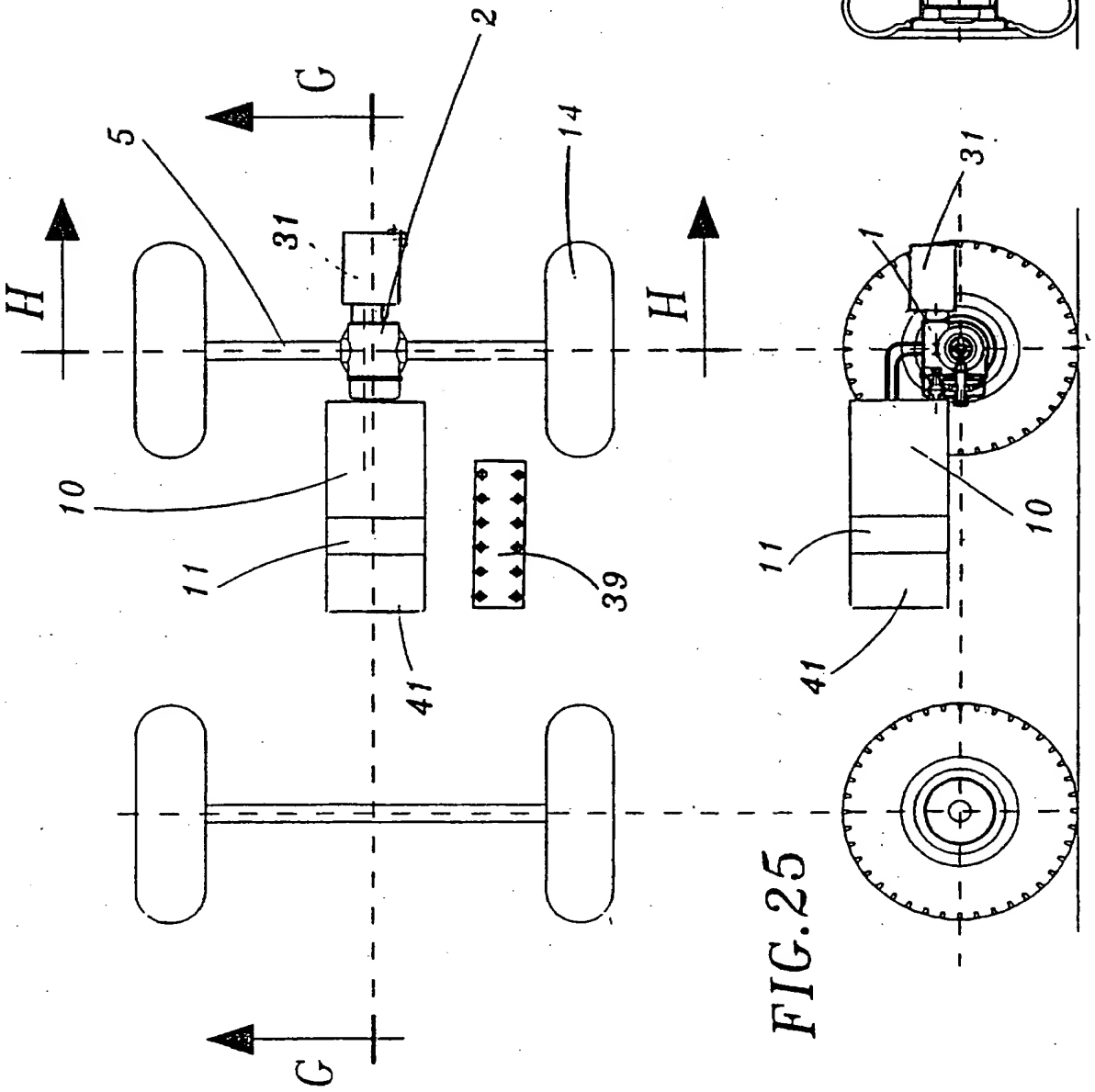


FIG.26

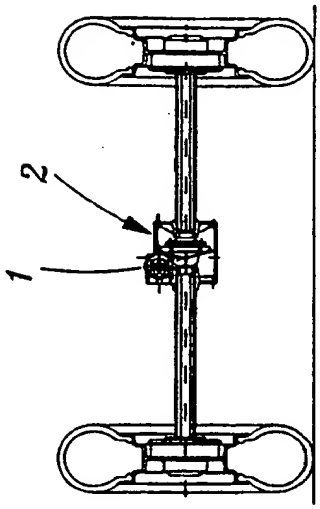


FIG.25

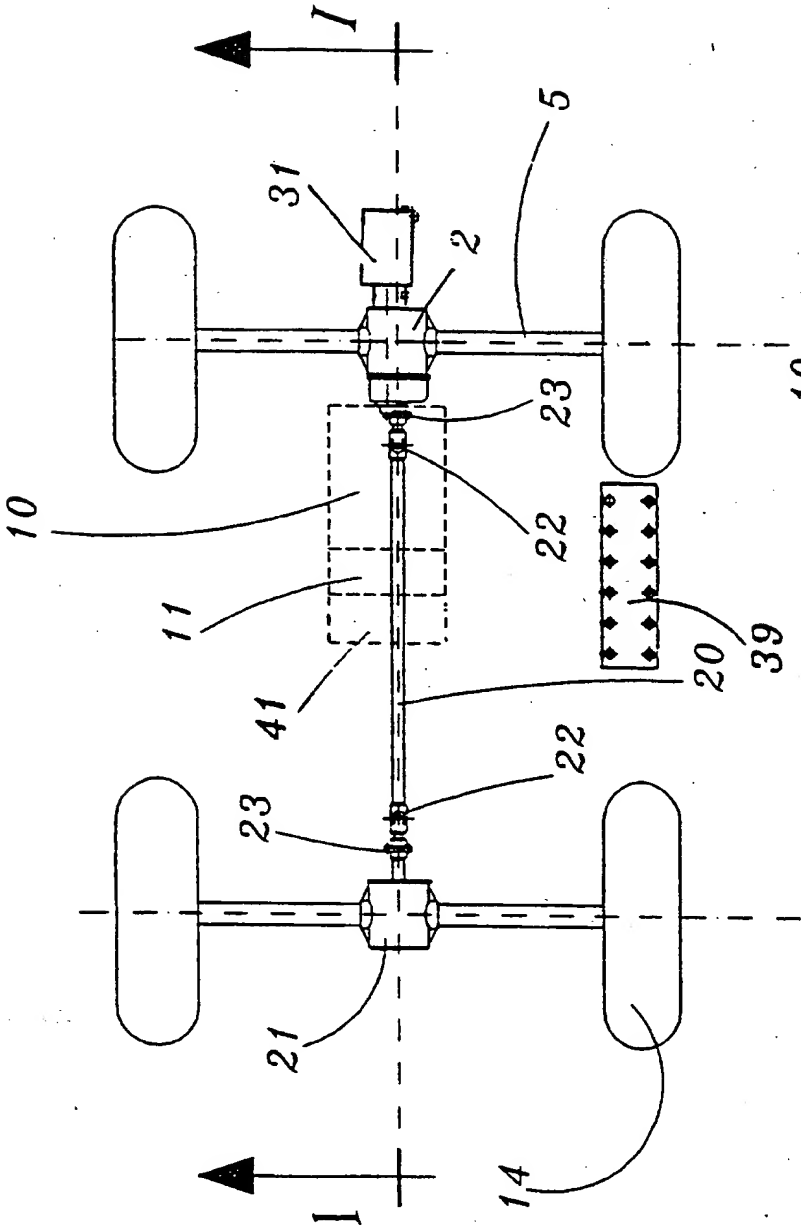


FIG.27

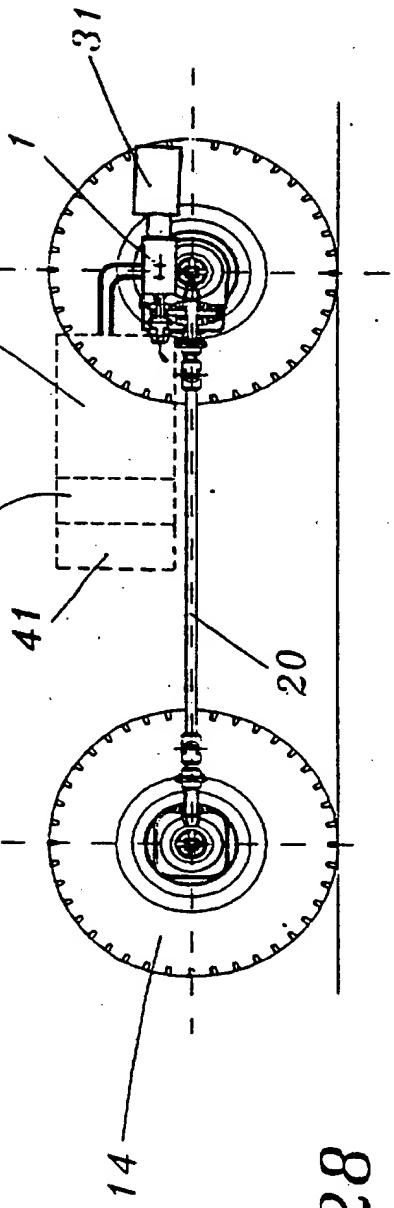


FIG.28

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT 95/00134

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B60K 6/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B60K, F02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
A	DE, A1, 4118678 (WODNI, DETLEF, PROF. DIPL.-ING.), 10 December 1992 (10.12.92), figure 1, abstract --	1-25
A	DE, A1, 4436383 (AUDI AG), 20 April 1995 (20.04.95), figure 1, claim 1 --	1-25
A	DE, A1, 4444545 (VOLKSWAGEN AG), 29 June 1995 (29.06.95), figure 1, abstract --	1-25
A	US, A, 2987134 (J.T. MYERS), 6 June 1961 (06.06.61), figure 1 --	1,21,22

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 October 1995	10. 11. 95
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl. Fax: (+31-70) 340-3016	Authorized officer Kenneth Gustafsson

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IT 95/00134

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4116006 (WALLIS), 26 Sept 1978 (26.09.78), figures 1-10, abstract --	1-25
A	US, A, 4502558 (MAURI), 5 March 1985 (05.03.85), column 2, line 25 - line 44, figure 1 -- --------	1-25

SA 14326

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/10/95

International application No.
PCT/IT 95/00134

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
DE-A1- 4118678	10/12/92	NONE		
DE-A1- 4436383	20/04/95	NONE		
DE-A1- 4444545	29/06/95	NONE		
US-A- 2987134	06/06/61	NONE		
US-A- 4116006	26/09/78	CA-A-	1031174	16/05/78
		DE-A-	2610098	23/09/76
		FR-A,B-	2303949	08/10/76
		GB-A-	1529503	25/10/78
		JP-C-	1004528	30/06/80
		JP-A-	51119404	20/10/76
		JP-B-	54034847	30/10/79
		SE-B,C-	432223	26/03/84
		SE-A-	7601698	13/09/76
		US-A-	4027485	07/06/77
US-A- 4502558	05/03/85	NONE		

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